



FRONTGRADE

APPLICATION NOTE

59005333-EVAL

AN59005333-EVAL

Three Output NiPOL Converter Evaluation Board

2/12/2025

Version #: 1.0.1

Contents

1.0 Introduction	3
0 Features	3
2.0 Absolute Maximum Ratings	4
3.0 Board Interfaces	4
4.0 Board Features	5
4.1 Enable/Disable	5
4.2 Voltage Trim Control	5
4.3 Soft Start	6
4.4 Output Voltage Measurement	6
4.5 Power Good	6
5.0 Test Setup	7
6.0 Schematic Diagram	8
7.0 Bill of Materials	9

Figures

Figure 1: Evaluation Board	3
Figure 2: Enable/Disable Switch	5
Figure 3: Voltage Set Jumper	5
Figure 4: Output Scope Connectors	6
Figure 5: Test setup	7
Figure 6: Evaluation Schematic	8
Figure 7: Test Point Schematic	8

Tables

Table 1: Evaluation Board Part Number	3
Table 2: Absolute Maximum Ratings	5
Table 3: Board Interfaces	5
Table 4: Bill of Materials	9

1.0 Introduction

This application note is for the Frontgrade Three-Output NiPOL Converter Evaluation Board. This evaluation board is populated with one Three-Output NiPOL Converter module. The Frontgrade Three-Output NiPOL DC-DC Converter are a series of efficient step-down regulators rated at 18 Watts output each. An external programming resistor provides accurate output voltage set for each.

EVALUATION BOARD PART NUMBERS				
Evaluation Board Part Number	Converter Part Number	Input Voltage	Output Voltage	Output Current
59005333-ASD4	59005333-S	4.5-5.5V	0.8-3.3V	6A

1.1 Features

The 59005333 Evaluation Board has all of the features necessary to fully evaluate the converter module. There are input and output binding posts for quick setup as well as scope probe test point to accurately measure output ripple. Input and output ceramic capacitors are included, as well as tantalum output capacitors to assure stability and transient response. The board includes access to all of the converter module features, including output sense, soft-start, and output voltage set adjustment. There is an enable switch, as well as jumper to enable/disable output voltage set on each channel. The board has standoffs installed so it may stand with either side up for easy access to all features.

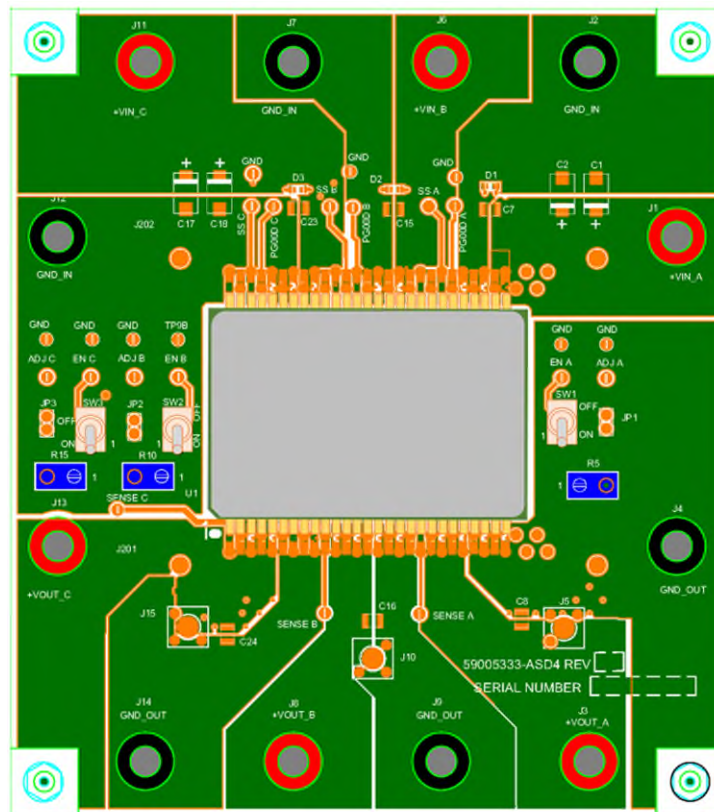


Fig 1. Evaluation board

2.0 Absolute Maximum Ratings

Parameter	Range	Units	Notes
Input Voltage per channel	0 to 5.5	V _{DC}	
Output Voltage	0.6 to 3.5	V _{DC}	
Output Current	0 to 10	A	
Ambient Temperature	-40 to +85	°C	
Storage Temperature	-40 to +85	°C	

Table 2

3.0 Board Interfaces

Signal Name	Description	Test Point	Connector
VIN A	External 5V input	-	J1
GND IN A	External 5V input return	-	J2
VOUT A	Output voltage of converter module A	J5	J3
GND OUT	Converter output voltage return	-	J4
ENABLE A	Pulled HIGH to converter input voltage using a switch to enable the converters. Ground to disable converter output. See SCD59005333 datasheet for details	EN A	-
ADJUST A	Adjusts output voltage of converter module A by an external programming resistor	ADJ A	-
SOFT START A	This pin allows for rise time longer than the default 2.6 ms by adding an external capacitor. See SCD59005333 datasheet for details	SS A	-
SENSE A	Output voltage sense	SENSE A	-
POWER GOOD A	Open-drain logic output that is pulled to GND when the output voltage is outside a ±11% typical regulation window	PGOOD A	-
VIN B	External 5V input	-	J6
GND IN B	External 5V input return	-	J7
VOUT B	Output voltage of converter module B	J10	J8
GND OUT	Converter output voltage return	-	J9
ENABLE B	Pulled HIGH to converter input voltage using a switch to enable the converters. Ground to disable converter output. See SCD59005333 datasheet for details	EN B	-
ADJUST B	Adjusts output voltage of converter module B by an external programming resistor	ADJ B	-
SOFT START B	This pin allows for rise time longer than the default 2.6 ms by adding an external capacitor. See datasheet for details	SS B	-
SENSE B	Output voltage sense	SENSE B	-
POWER GOOD B	Open-drain logic output that is pulled to GND when the output voltage is outside a ±11% typical regulation window	PGOOD B	-
VIN C	External 5V input	-	J11
GND IN C	External 5V input return	-	J12
VOUT C	Output voltage of converter module C	J5	J3
GND OUT	Converter output voltage return	-	J14
ENABLE C	Pulled HIGH to converter input voltage using a switch to enable the converters. Ground to disable converter output. See SCD59005333 datasheet for details	EN C	-
ADJUST C	Adjusts output voltage of converter module C by an external programming resistor	ADJ C	-
SOFT START C	This pin allows for rise time longer than the default 2.6 ms by adding an external capacitor. See datasheet for details	SS C	-
SENSE C	Output voltage sense	SENSE C	-
POWER GOOD C	Open-drain logic output that is pulled to GND when the output voltage is outside a ±11% typical regulation window	PGOOD C	-
GND	Signal ground reference point	GND	-

Table 3

4.0 Board Features

4.1 Enable/Disable

Each converter channel is independently controlled by its respective enable pin. A switch is used to set enable pin high to input voltage or low to ground.

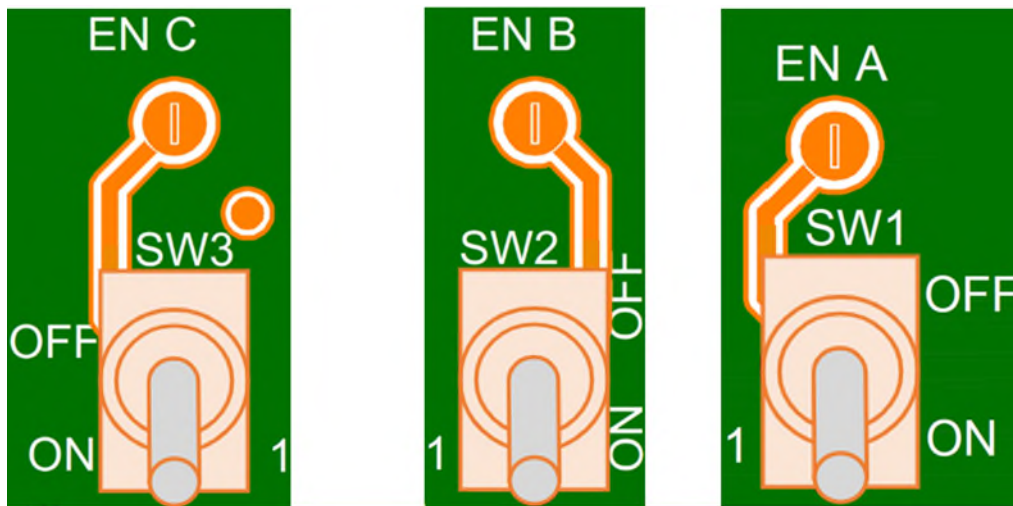


Fig. 2

4.2 Voltage Trim Control

Each converter channel can be independently adjusted via the external potentiometer. Removing the jumper will set the output voltage to nominal 0.6V. To calculate the external ADJ programming resistor, calculation is as follows:

First, calculate the total programming resistor using $R_{tot} = 1/[(V_{out}/.6)-1]$, where V_{out} is in volts and R_{tot} in k-ohms. Then since there is an internal 10k programming resistor in parallel with the external resistor, calculate the external resistor value using $R_{adj} = (10 \times R_{tot}) / (10 - R_{tot})$, where R_{adj} is in k-ohms.

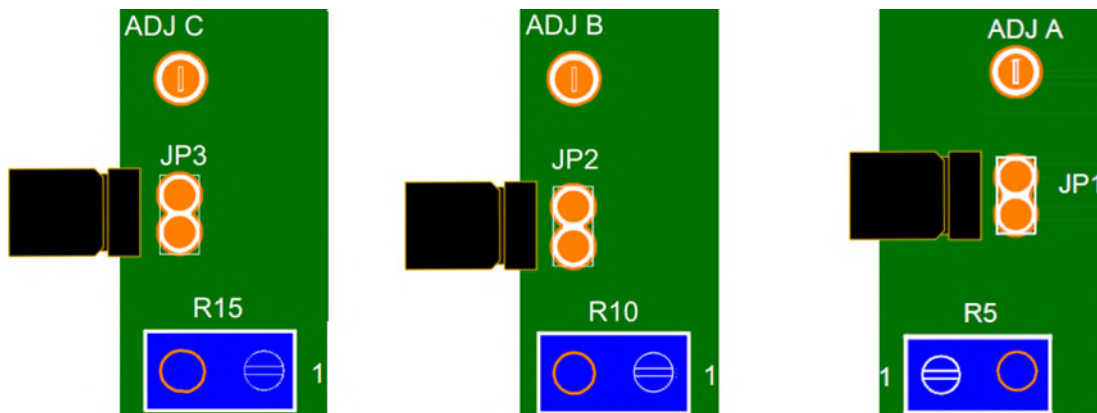


Fig. 3

4.3 Soft Start

This pin allows for Vout rise time longer than the ideal default 2ms by adding an external capacitor. 10% to 90% rise time can be calculated by the following functioning which C_{ss} is the external capacitance.

$$C_{ss} = (Trise / 20) - 0.1$$

where Trise is in ms, C_{ss} in uF

4.4 Output Voltage Measurement

For precise measurements, utilize the Tektronix scope probe test points (J5 J10 J15) to observe output voltage ripple with low impedance.

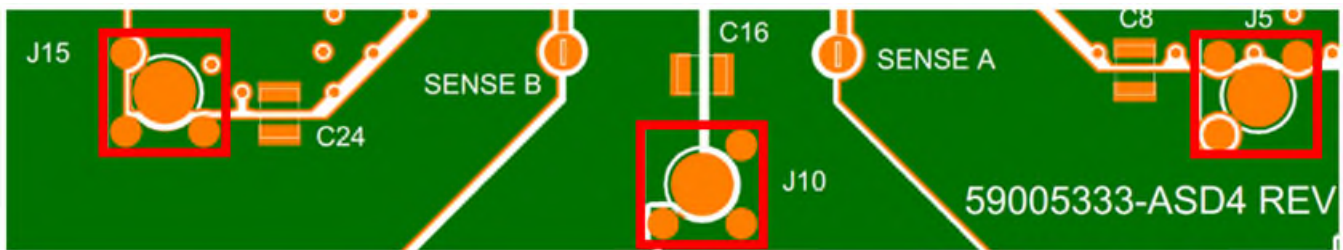


Fig. 4

4.5 Power Good

Each channel of the converter has a respective power good output signal. The power good signal will output from 4.5-5.5V when the channel is enabled and when the output voltage is within $\pm 11\%$ regulation window. Thus, turning on the red LED to indicate normal operation.

4.5 Sense Pin

Connect this pin as close to the load as possible to reduce the sensitivity of the power converter regulation to the distribution resistance. If the SENSE pin is not connected, the converter will regulate at its output pin.

5.0 Test Setup

Required set up for the 59005333 Evaluation board.

- 1) Electronic load able to sink up to 10A of constant current or resistive load.
- 2) Power supply with a 13A current source capability
- 3) Oscilloscope to measure SS, EN, Vout

5.1 Terminals and Test Points

Connect the input power and the output load to the binding posts as shown in Figure 5. Each converter has an independent voltage input supply. Connect DMM and Oscilloscope probes to the Test Points as shown in the Figures 3 through 5 and described in the tables.

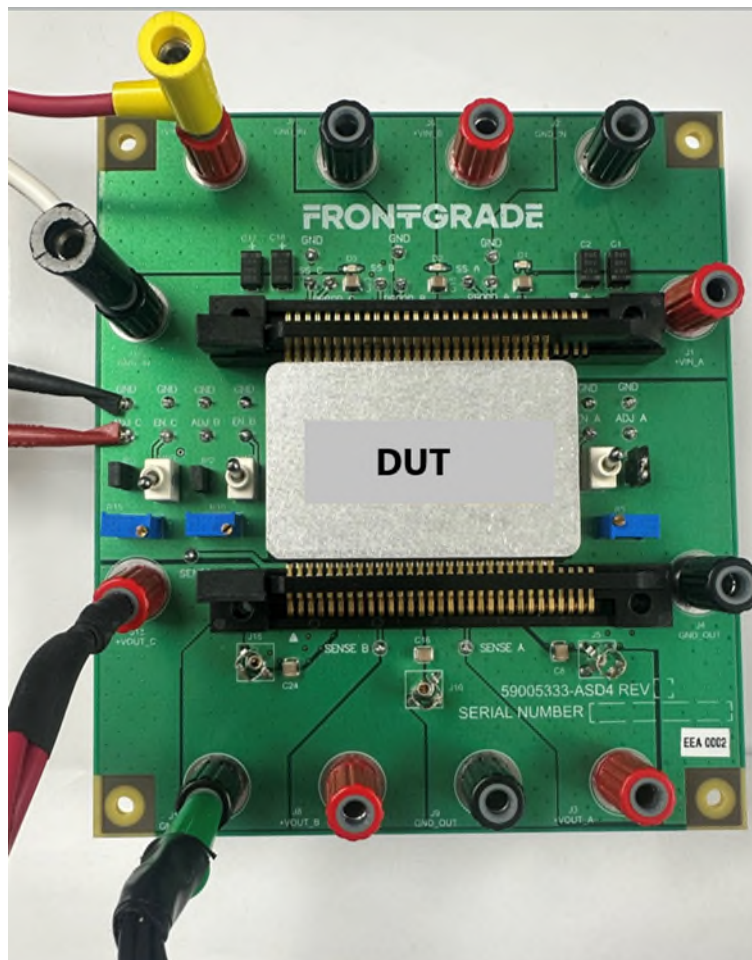


Fig. 5

6.0 Schematic Diagram

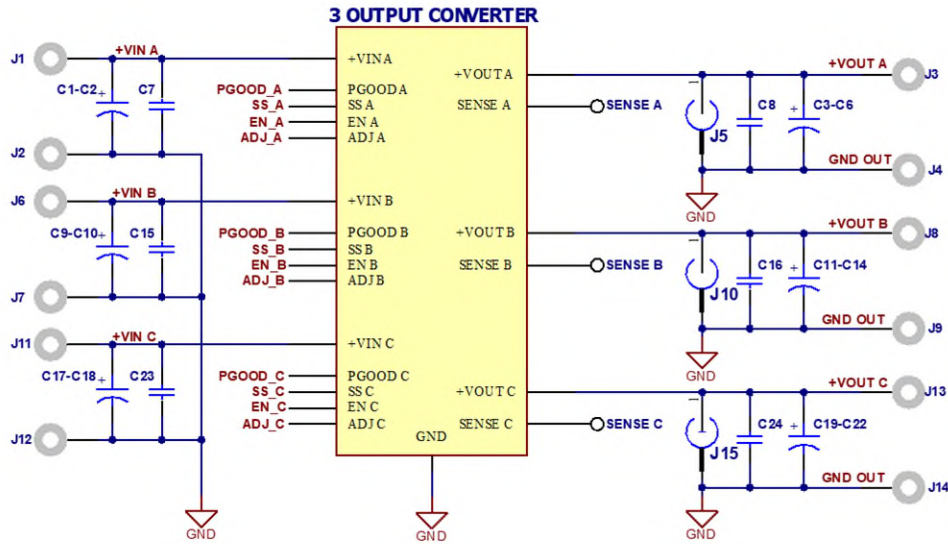


Fig. 6

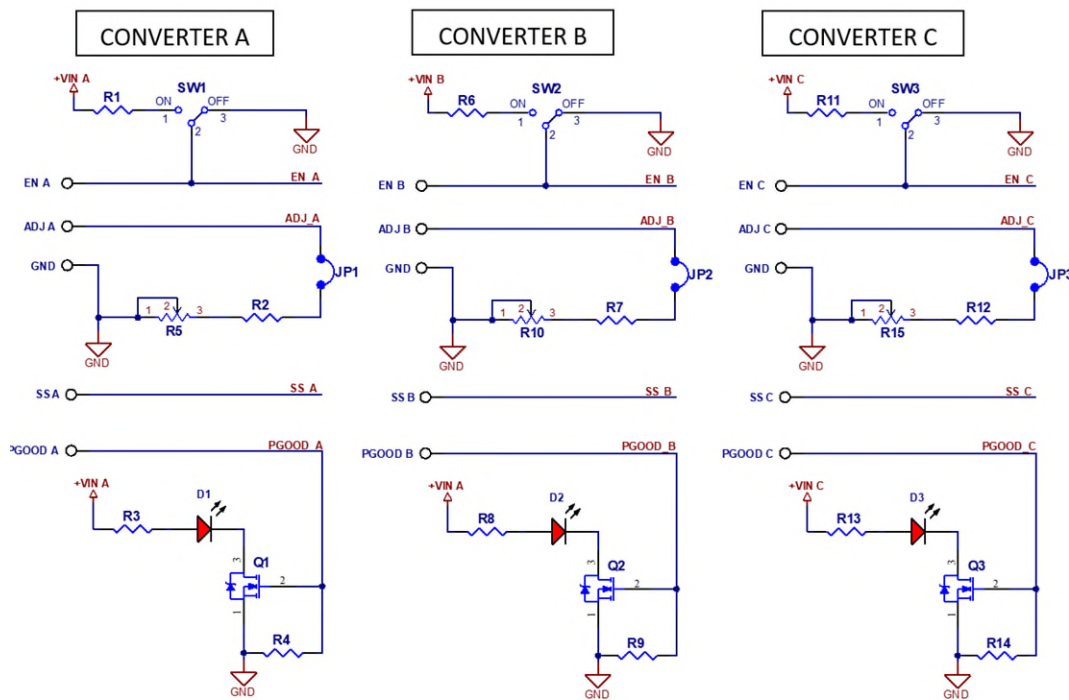


Fig. 7

7.0 Bill of Materials

QTY	PART	MANUFACTURER	DESCRIPTION	REF.DESIGNATOR
1	25H5682-01	Frontgrade	PCB Evaluation Board	
6	CT2234-2	Cal Test	Binding Post, Red	J1, J3, J6, J8, J11, J13
6	CT2234-0	Cal Test	Binding Post, Black	J2, J4, J7, J9, J12, J14
18	T530D157M010ATE005	Kemet	CAP TANT 150UF 20% 10V 2917	C1, C2, C3, C4, C5,C6, C9,C10, C11,C12, C13, C14, C17,C18, C19, C20, C21,C22
6	C1210T226K8RCL7800	Kemet	CAP CER 22uF 10V 10% X7R 1210	C7, C8, C15, C16, C23, C24
3	HSMH-C170	Broadcom	Red LED SMD	D1, D2, D3
3	131-4353-00	Tektronix	Tektronix Test Connector	J5,J10,J15
3	SPC02SYAN	Sullins	2 Position Jumper	JP1, JP2, JP3
3	5-146281-2	TE	2 Position Header 2.54mm	JP1, JP2, JP3
3	2N7002-7-F	Diodes Incorporated	MOSFET N-Ch 60V SOT23-3	Q1, Q2, Q3
3	ERJ-2RKF2211X	Panasonic	Resistor 2.21k 1% 0402	R1,R6,R11
3	ERJ-2RKF1500X	Panasonic	Resistor 150 1% 0402	R2,R7,R12
3	ERJ-2RKF1001X	Panasonic	Resistor 1.00k 1% 0402	R3,R8,R13
3	ERJ-2RKF3322X	Panasonic	Resistor 33.2k 1% 0402	R4,R9,R14
3	3296W-1-502LF	Bourns	Resistor Trim Pot 5k 10%	R5,R10,R15
3	ET01MD1CBE	C&K	Switch Toggle SPDT 0.4VA 20V	SW1, SW2, SW3
24	36-5020	Keystone	Low Profile Test Point	EN A, EN B, EN C, ADJ A, ADJ B, ADJ C, SS A, SS B, SS C, GND
1	59005333	Frontgrade	3 Output NiPOL Converter	U1

Revision History

Date	Revision #	Author	Change Description	Page #
02/12/25	1.0.1	JP	Initial Release	

Datasheet Definitions

	Definition
Advanced Datasheet	Frontgrade reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the datasheet is subject to change . Specifications can be TBD and the part package and pinout are not final .
Preliminary Datasheet	Frontgrade reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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